

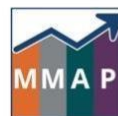
# Preparatory Pathways and STEM Calculus Completion for Students with Disabilities

Implications of the AB 1705 Standards

AUGUST 2024



California  
Community  
Colleges



Multiple Measures  
Assessment Project

TheRPGroup

## Introduction

[Assembly Bill \(AB\) 1705](#) requires community colleges to ensure that students pursuing calculus-based programs in Science, Technology, Engineering and Math (STEM) begin math in the course that best positions them to complete their calculus requirement. According to the law, a college has this obligation for all STEM students, regardless of their background or special population status.

Previous research conducted by The RP Group's Multiple Measures Assessment Project (MMA P) and summarized in [Preparatory Pathways and STEM Calculus Completion: Implications of the AB 1705 Standards](#) found high rates of attrition along the path to calculus for students who began in preparatory courses. When grouped by level of high school math preparation, for every group, students who directly enrolled in STEM Calculus 1 were more likely to complete calculus in two years than those who started in preparatory coursework. This finding was also true across placement levels defined by a combination of high school grade point average and high school math preparation.

**This brief provides additional analysis focusing on STEM students with disabilities whose first college math course was in the STEM Calculus pathway.** We specifically examine the math outcomes of students who received services from Disabled Students Programs and Services ([DSPS](#)) while enrolled at a California community

### Key Terms

**STEM Calculus Pathway:** A sequence of courses comprised of one or more transfer-level preparatory courses and STEM Calculus 1.

**Direct Enrollment:** student's first math enrollment in the California community college system, not necessarily in the freshman year.

**STEM Calculus 1:** The first STEM Calculus course, equivalent to C-ID Math 210, 211, or the first half of Math 900S.

**Preparatory Course:** A transfer-level math course required in the path to STEM Calculus 1 that may include College Algebra, Trigonometry, or Precalculus.

**STEM Calculus 1 Two-Year Throughput:** Proportion of the cohort starting in a specified course in the STEM Calculus Pathway (College Algebra, Trigonometry, Precalculus, or STEM Calculus 1) who successfully completed STEM Calculus 1 (with a C or better) within two years.

college. We begin with a short overview of the methodology, followed by key findings and conclusions.

## Methodology

This analysis of preparatory pathways and STEM Calculus 1 completion for students with disabilities extends our original research and applies the same methodology used in the statewide analysis of all STEM majors.<sup>1</sup>

In summary, data were obtained from the California Partnership for Achieving Student Success (CalPASS), with technical assistance from Education Results Partnership (ERP), which managed the system. The CalPASS data system contains anonymous and encrypted student-level data from participating K–12 and postsecondary institutions, including data from the Chancellor’s Office Management Information System (COMIS) and from the centralized California community college application, CCCApply.

We identified STEM students as those who had declared a major that require STEM Calculus 1 using the methodology from the main report, which was based on [C-ID Transfer Model Curricula](#) and the following TOP Codes: 1905.00, 0706.00, 0707.00, 0707.10, 0901.00, 1914.00, 1701.00, 1902.00, 0401.00, 4902.00. We defined the starting cohort by STEM students’ first math enrollment within the California Community Colleges (CCC), where their first math course attempted was a transfer-level preparatory course in the STEM calculus pathway or STEM Calculus 1. For this brief, we disaggregated the cohort by DSPS status. DSPS students were further categorized by the following disability types as defined in COMIS:

- ABI = Acquired Brain Injury
- ADHD = Attention Deficit Hyperactivity Disorder
- Autism = Autism Spectrum
- Blindness = Blind and Low Vision
- DHH = Deaf and Hard of Hearing
- Intellectual = Intellectual Disability
- Learning = Learning Disability
- Mental = Mental Health Disability
- Physical = Physical Disability
- Other = Other Health Conditions and Disabilities

We did not include Speech/Language Impaired because data collection for students with this disability ended in 2017-2018. In the analysis, we categorized disabled STEM students who did not participate in their college’s DSPS program as non-DSPS.

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<sup>1</sup> Find full methodology in the [technical appendix](#) to the main report.

AB 1705 makes an exception for students with documented disabilities participating in a college’s educational assistance classes “who are otherwise unable to benefit from general college classes, even with appropriate academic adjustments, auxiliary aids, and services.”<sup>2</sup> DSPS students with this exemption would not be enrolled in the calculus pathway because they are not enrolled in college classes and are therefore not included in this analysis.

We grouped students using the STEM Calculus Pathway placement profiles defined by the California Community Colleges Chancellor’s Office (CCCCO) in February 2024.<sup>3</sup> Students with a higher STEM placement profile have a HSGPA of 2.6 or greater and have passed high school Precalculus or Trigonometry with a grade of C or higher. The lower placement profile includes everyone else, specifically students who meet one or both of the following: (1) HSGPA less than 2.6 and/or (2) have not passed high school Precalculus or Trigonometry. It is important to note that these placement profiles were not used by community colleges during the timeframe of this study. In fact, research shows that math placement policies and practices varied widely across colleges and shifted during the timeframe of this study, including the ways in which students could gain access to calculus through a local matriculation process.<sup>4</sup>

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<sup>2</sup> AB 1705 section 78213 (j)(4). Educational assistance classes are described in Title 5 of the California Code of Regulations, Section 56028.

<sup>3</sup> See the California Community Colleges Chancellor’s Office [memorandum](#).

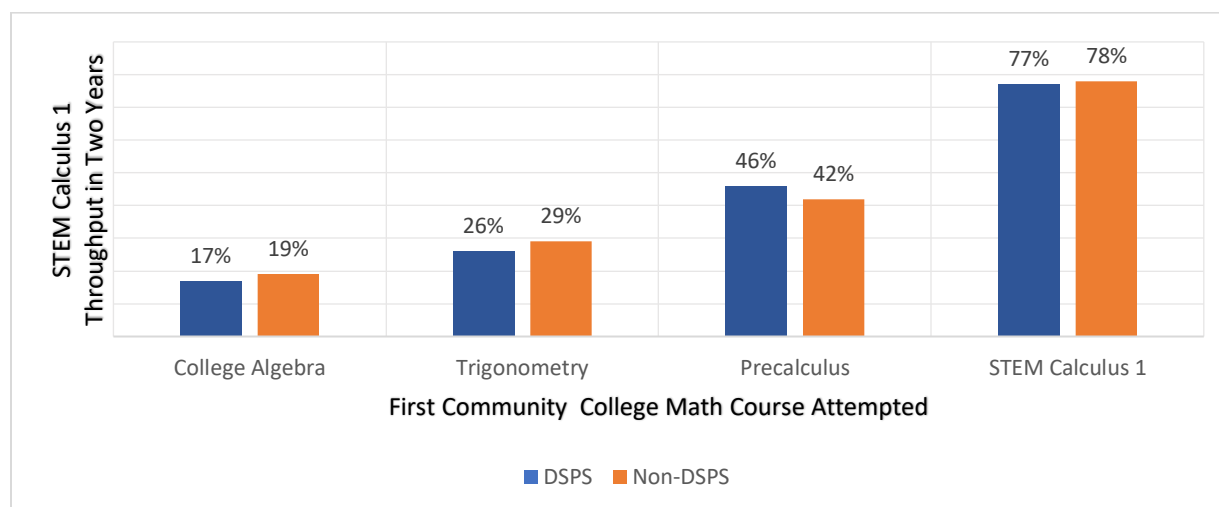
<sup>4</sup> See Appendix I of the [main report](#) for an overview of math placement and calculus access policies across the 115 California community colleges and across the cohort years for this analysis.

## Key Findings

**For DSPS students, STEM Calculus 1 completion was highest with direct enrollment into STEM Calculus 1 and progressively lower for students starting in Precalculus, Trigonometry, and College Algebra.**

For each starting point in the calculus pathway, DSPS students' two-year STEM Calculus 1 throughput rates were nearly the same as the throughput rates of non-DSPS students (77% and 78%, respectively) and consistent with patterns observed in the original report for all STEM students (Figure 1).

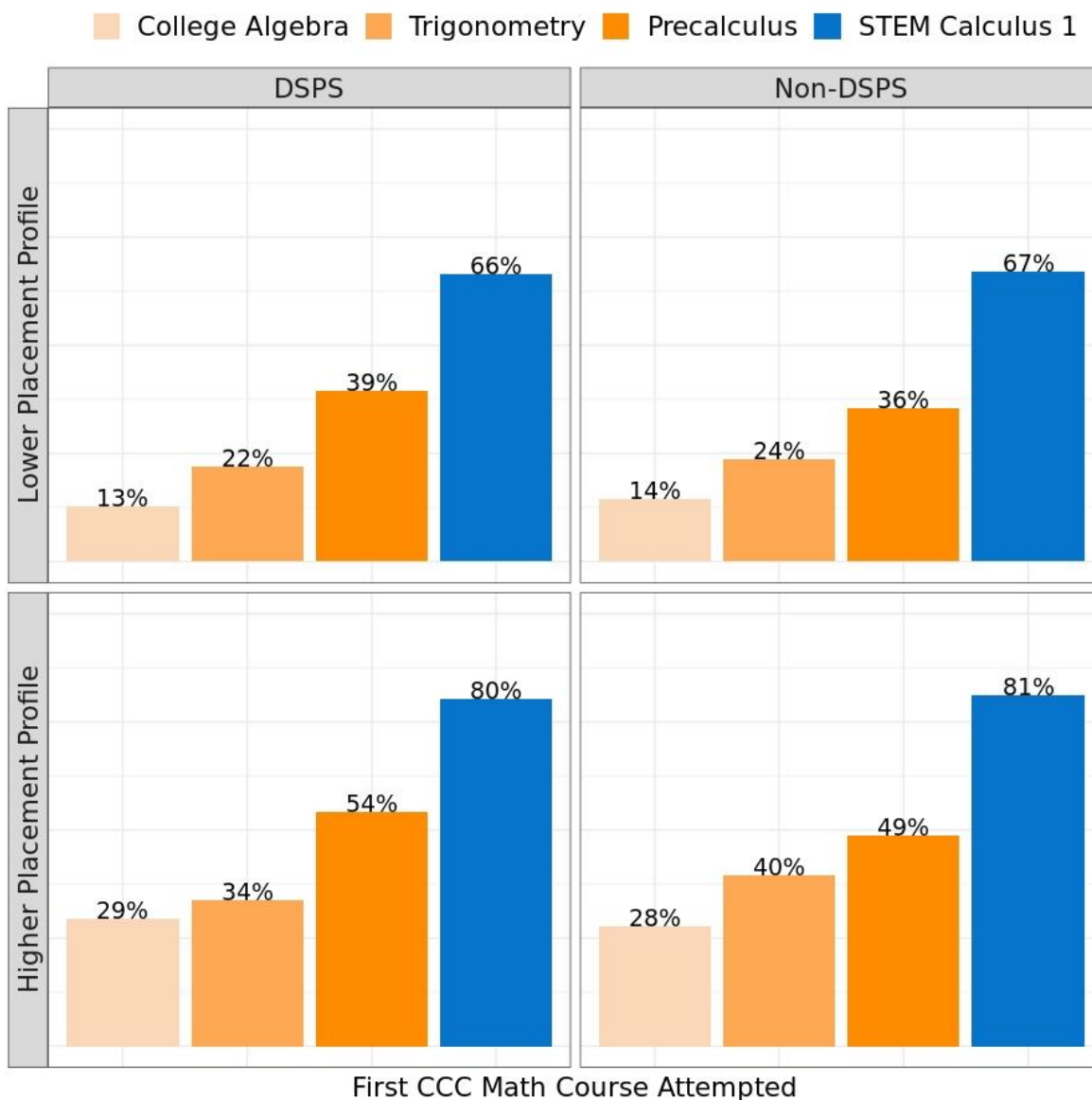
**Figure 1. STEM Calculus 1 Two-Year Throughput by DSPS Status and First CCC Math Course Attempted**



Cohort: STEM students with initial math enrollment in 2012-2013 through 2019-2020, excluding students whose first math enrollment was in summer, tracked for two years.

**Regardless of DSPS status, lower and higher placement profile groups had the same patterns in calculus completion based on students' starting point in the STEM calculus pathway.** Across placement groups, the two-year throughput for STEM Calculus 1 is highest with direct enrollment into STEM Calculus 1 and progressively lower for DSPS STEM students starting college math in Precalculus, Trigonometry, and College Algebra (Figure 2).

**Figure 2. STEM Calculus 1 Two-Year Throughput by DSPS Status, Placement Group, and First CCC Math Course Attempted**



Cohort: STEM students with initial math enrollment between 2012-2013 and 2019-2020, excluding students whose first math enrollment was in summer, tracked for two years.

Higher placement profile: HSGPA of 2.6 or greater and a C or better in high school Precalculus or Trigonometry.

Lower placement profile: one or both of the following: (1) HSGPA less than 2.6, and/or (2) did not take or pass high school Precalculus or Trigonometry. See Table 2 in the Appendix for cohort counts.

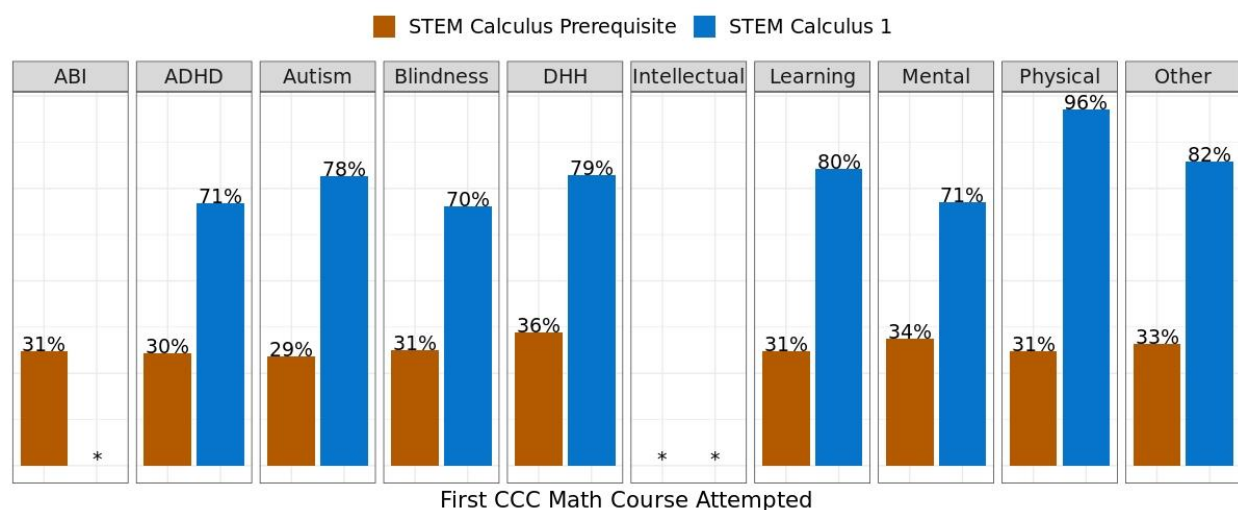
In addition to consistent throughput patterns, DSPS students' throughput rates are often within a few percentage points of the rates for non-DSPS students with the same placement profile who start in the same course. For example, for students in the lowest placement group with a College Algebra start, calculus completion in two years was 13% for DSPS students and 14% for non-DSPS students.

Regardless of DSPS status, a lower placement profile is associated with lower calculus completion for students starting in the same course. For example, for students starting in College Algebra, the calculus throughput was 13% for DSPS students with the lowest placement profile and 29% for DSPS students in the higher placement group. For non-DSPS students, the completion rates were 14% and 28%, respectively.

However, as seen in previous analyses, the course in which a student starts appears to have a larger impact on calculus completion than the student's placement profile, for both DSPS and non-DSPS students. For example, DSPS students with a lower placement profile who started in STEM Calculus completed at a higher rate (66%) than both DSPS and non-DSPS students with a higher placement profile who started in a preparatory course (29%-54% and 28%-49%, respectively.)

**Across different types of disabilities, students who started in STEM Calculus 1 were more likely to complete Calculus than students who started in a preparatory course (Figure 3).**

**Figure 3. STEM Calculus 1 Two-Year Throughput Rates by Disability Type and Level of First CCC Math Attempted**



Cohort: STEM students with initial math enrollment in 2012-2013 through 2019-2020, excluding students whose first math enrollment was in summer, tracked for two years. For cohort counts, see Table 3 in the Appendix.

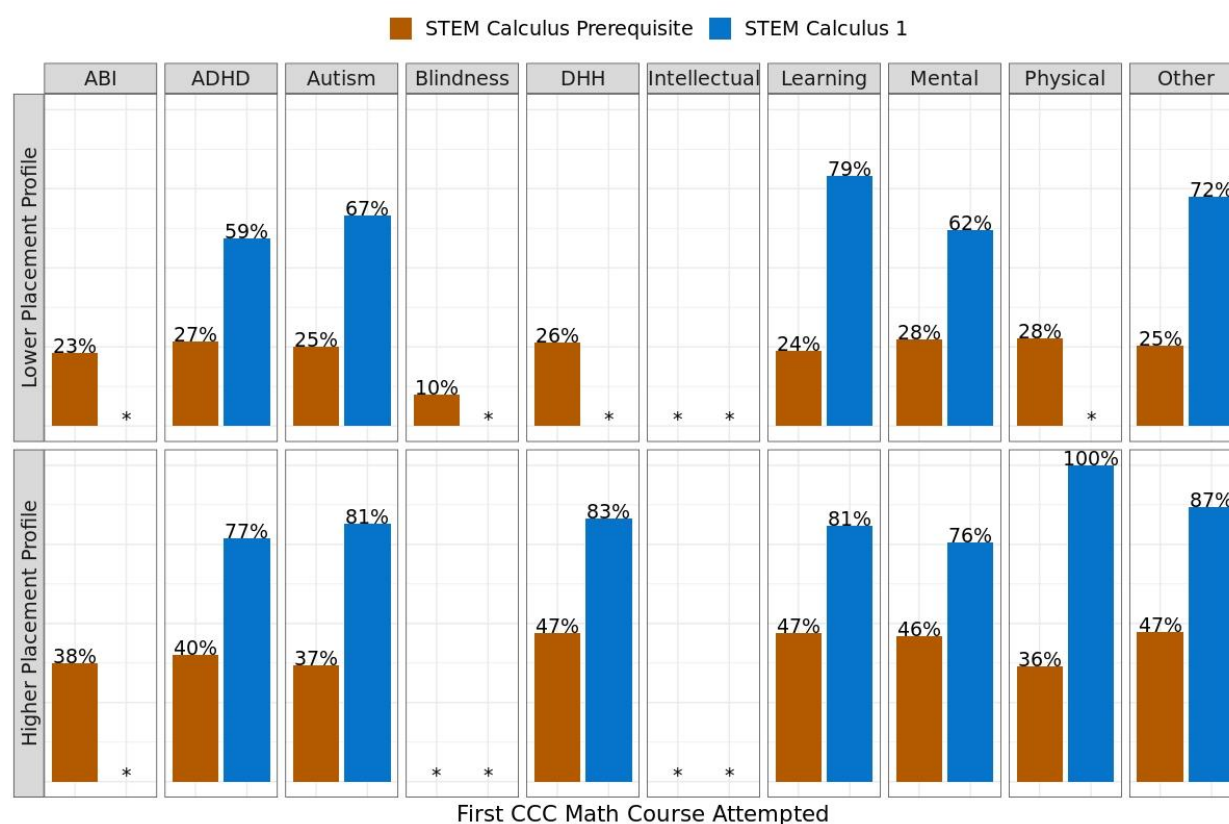
Notes: Throughput rates are suppressed for groups with fewer than 10 students, as indicated by an asterisk.

Students with more than one disability are counted in the throughput rates for all relevant disability groups. For example, a student with a Learning Disability and ADHD is considered in both the Learning Disability and ADHD categories.

When sample sizes were large enough to analyze, two-year throughput for students starting in preparatory coursework was similar across disability types, ranging from 29% to 34%. For students starting in STEM Calculus 1, throughput rates were more than twice the rates of students with similar disabilities who started in a preparatory course.

With further disaggregation by placement profile, sample sizes for some disability types become too small for analysis. Yet, when analysis was possible, the same pattern persisted. **For both placement profiles, students who started in STEM Calculus 1 were more likely to complete Calculus in two years than students who started in a preparatory course across all disability types for which there were sufficient data** (Figure 4).

**Figure 4. STEM Calculus 1 Two-Year Throughput by Disability Type, Placement Group, and Level of First CCC Math Course Attempted**



Cohort: STEM students with initial math enrollment in 2012-2013 through 2019-2020, excluding students whose first math enrollment was in summer, tracked for two years.

Higher placement profile: HSGPA of 2.6 or greater and a C or better in high school Precalculus or Trigonometry.

Lower placement profile: one or both of the following: (1) HSGPA less than 2.6, and/or (2) did not take or pass high school Precalculus or Trigonometry.

Notes: Throughput rates are suppressed for groups where there were fewer than 10 students in the starting cohort, as indicated by an asterisk. Students with more than one disability are counted in the throughput rates for all relevant disability groups.



As before, for the same starting course level, students with the lower placement profile have lower calculus completion than students with the higher placement profile across disability types for which there were sufficient data. However, the hindering effect of a preparatory start for students in the higher placement group is starkly underscored by the higher completion rates achieved by the students from the lower placement group who started in STEM Calculus 1. Across disability types, two-year throughput was at least 59% for students from the lowest placement profile who started in STEM Calculus 1. On the other hand, the highest throughput achieved by students from the highest placement group who began in a preparatory course was 47%.

## Conclusion

In California's community colleges, **STEM students participating in DSPS programs have STEM Calculus completion rates similar to those of non-DSPS students.** As we have observed in previous analyses of the entire STEM cohort, throughput patterns are predictable based on the first college math course attempted or the starting college math level. DSPS status, higher or lower placement profile, and disability type do not disrupt these familiar trends. When the STEM cohort is disaggregated based on these student characteristics, students enrolling directly in STEM Calculus 1 as their first California community college math course have higher rates of calculus completion in two years than students starting in preparatory coursework. We have observed the same hindering effect of preparatory coursework on calculus completion across every disaggregation of STEM students we have examined to date.

These data suggest that providing direct access to STEM Calculus 1 with concurrent, targeted Precalculus support, along with disability accommodations, holds promise as a strategy for ameliorating attrition in the calculus pathway and supporting more STEM students with disabilities to complete calculus requirements for their programs.



## Appendix: Data Tables

**Table 1. STEM Calculus 1 Two-Year Throughput Rate (TR%) by DSPS Status and First CCC Math Course Attempted**

First CCC Math Course Attempted	DSPS Students			Non-DSPS Students		
	Completed	Cohort	TR%	Completed	Cohort	TR%
College Algebra	49	294	17%	948	5,134	19%
Trigonometry	127	497	26%	2,640	8,992	29%
Precalculus	253	549	46%	4,226	10,118	42%
STEM Calculus 1	381	498	77%	8,719	11,150	78%
Total	810	1,838	44%	16,533	35,394	48%

Cohort: STEM students with initial math enrollment in 2012-2013 through 2019-2020, excluding students whose first math enrollment was in summer, tracked for two years.

**Table 2. STEM Calculus 1 Two-Year Throughput Rate (TR%) by DSPS Status, Placement Group, and First CCC Math Course Attempted**

First CCC Math Course Attempted	Lower Placement Profile						Higher Placement Profile					
	DSPS Students			Non-DSPS Students			DSPS Students			Non-DSPS Students		
	Completed	Cohort	TR%	Completed	Cohort	TR%	Completed	Cohort	TR%	Completed	Cohort	TR%
College Algebra	29	226	13%	515	3,580	14%	20	68	29%	433	1,554	28%
Trigonometry	75	343	22%	1,354	5,749	24%	52	154	34%	1,286	3,243	39%
Precalculus	120	304	40%	1,878	5,285	36%	133	245	54%	2,348	4,833	49%
STEM Calculus 1	93	140	66%	1,569	2,345	67%	288	358	80%	7,150	8,805	81%
Total	317	1,013	31%	5,316	16,959	31%	493	825	60%	11,217	18,435	61%

Cohort: STEM students with initial math enrollment in 2012-2013 through 2019-2020, excluding students whose first math enrollment was in summer, tracked for two years.

**Table 3. STEM Calculus 1 Two-Year Throughput Rate (TR%) by Disability Type and First CCC Math Attempted**

Disability Type	STEM Calculus Prerequisite			STEM Calculus I		
	Completed	Cohort	TR%	Completed	Cohort	TR%
<b>ABI</b>	9	29	31%	*	*	*
<b>ADHD</b>	65	214	30%	56	79	71%
<b>Autism</b>	53	180	29%	54	69	78%
<b>Blindness</b>	5	16	31%	7	10	70%
<b>DHH</b>	13	36	36%	11	14	79%
<b>Intellectual</b>	*	*	*	*	*	*
<b>Learning</b>	81	261	31%	53	66	80%
<b>Mental</b>	118	344	34%	106	149	71%
<b>Physical</b>	18	58	31%	26	27	96%
<b>Other</b>	118	358	33%	107	130	82%

Cohort: STEM students with initial math enrollment in 2012-2013 through 2019-2020, excluding students whose first math enrollment was in summer, tracked for two years.

Notes: Throughput rates are suppressed for groups where there were fewer than 10 students in the starting cohort, as indicated by an asterisk. Students with more than one disability are counted in the throughput rates for all relevant disability groups. For example, a student with a Learning Disability and ADHD is considered in both the Learning Disability and ADHD categories.

Disability types as defined in COMIS:

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**Table 4. STEM Calculus 1 Two-Year Throughput Rates (TR%) by Disability Type, Placement Group, and First CCC Math Course Attempted**

Disability Tye	STEM Calculus Prerequisite						STEM Calculus 1					
	Lower Placement Profile			Higher Placement Profile			Lower Placement Profile			Higher Placement Profile		
	Completed	Cohort	TR%	Completed	Cohort	TR%	Completed	Cohort	TR%	Completed	Cohort	TR%
<b>ABI</b>	3	13	23%	6	16	38%	*	*	*	*	*	*
<b>ADHD</b>	41	154	27%	24	60	40%	16	27	59%	40	52	77%
<b>Autism</b>	28	112	25%	25	68	37%	10	15	67%	44	54	82%
<b>Blindness</b>	1	10	10%	*	*	*	*	*	*	*	*	*
<b>DHH</b>	5	19	26%	8	17	47%	*	*	*	10	12	83%
<b>Intellectual</b>	*	*	*	*	*	*	*	*	*	*	*	*
<b>Learning</b>	42	178	24%	39	83	47%	15	19	79%	38	47	81%
<b>Mental</b>	60	218	28%	58	126	46%	31	50	62%	75	99	76%
<b>Physical</b>	10	36	29%	8	22	36%	*	*	*	22	22	100%
<b>Other</b>	59	233	25%	59	125	47%	29	40	73%	78	90	87%

Cohort: STEM students with initial math enrollment in 2012-2013 through 2019-2020, excluding students whose first math enrollment was in summer, tracked for two years.

Higher placement profile: high school GPA of 2.6 or greater and C or better in high school Precalculus or Trigonometry.

Lower placement profile: one or both of the following: (1) HSGPA less than 2.6, and/or (2) did not take or pass high school Precalculus or Trigonometry.

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